BIRZEIT UNIVERSITY

Faculty of Engineering and Information Technology

Computer Science Department

COMP242 Project #3

Project Title: Smart Warehouse Inventory and Shipment Management System

Project Overview

In this project, you will develop a **Smart Warehouse Inventory and Shipment Management System** using Java. The system models real-world warehouse operations, including product categorization, shipment processing, inventory updates, and tracking of canceled shipments.

The **Product Catalog** is organized as a **doubly linked list of product categories**, where **each category node (e.g., Electronics, Furniture)** contains a list of **products** (e.g., Laptops, Monitors, Desks).

Each **product** within a category maintains its own structures to manage shipments, inventory, and historical tracking. See **Figure 1** for an abstract overview.

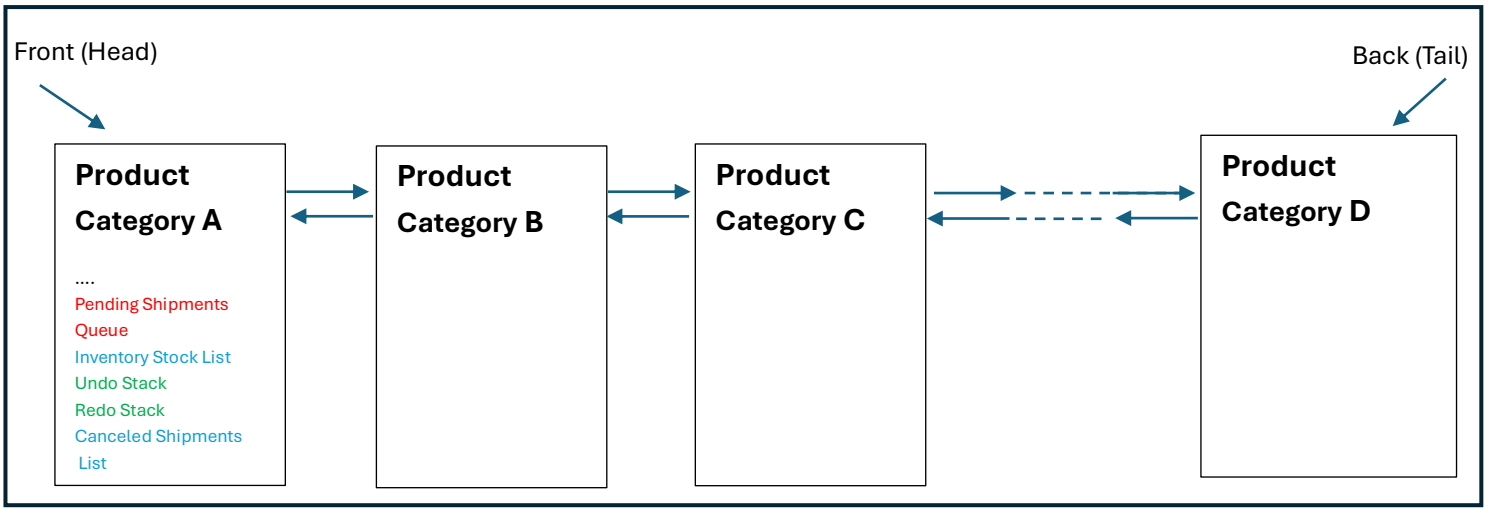

Figure 1: Abstract System Structure Overview

Important:

- **Product Catalog** contains multiple **Product categories** nodes.
- Each **product category** node contains a **queue** of pending shipments.
- When a shipment is approved, it is transferred to a separate inventory stock list, which is implemented using a **cursor-based array linked list**.
- A **stack** (Undo/Redo) is used to track stock modifications for each product.
- A **cursor-based linked list** is used to maintain a log of canceled shipments.
- Each product has a **status** (Active/Inactive) to allow for filtering and analysis.

As a student in the COMP242 course, you are required to implement this system while considering the following key features

System Menus & Features

1. Product Category Management

- **Add Category**: Create a new product category with a unique ID, name, description,etc (e.g., Electronics, Furniture, Office Supplies, etc.).
- **Update Category**: Modify existing category details such as name or description.
- **Delete Category**: when a user attempts to delete a category, prompt them with these choices:
    - Reassign products to another existing category before deleting them.
    - Cannot delete category until all products under it are removed or reassigned manually.
    - Force deletes — this will permanently remove the category and all its products.
- **Search Category**: Locate a category by its name.
- **List Categories**: Display all available categories in the system.

2. Product Management

- **Add Product**: Create a new product with a unique ProductID, Name, assign it to an existing Category, and set its Status (Active/Inactive).
- **Update Product**: Modify all product fields except ProductID.
- **Remove Product**: Delete a product using its ProductID.
- **Search Product**: Locate a product by its ProductID or Name.
- **Display All Products**: Show all products within the catalog with filter options:
    - Filter by Status: Active / Inactive
    - Filter by Category (e.g., Electronics, Furniture, Office Supplies, etc.)
- **Sort Products**:
    - By Name (alphabetically)
    - By Category (grouped under categories like Electronics, Furniture, etc.)
    - By Status (Active products shown before Inactive)

3. Shipment Management

- **Add Shipment to Product**: Add a new shipment to a product, including ShipmentID, Quantity, and Date.
- **Approve Shipment**: Approve the first shipment in the queue and move it to the inventory stock list. (Note: Implemented using a cursor-based array linked list.)
- **Cancel Shipment**: Move a shipment from the pending queue to the canceled shipments log. (Also uses a cursor-based linked list.)
- **Log Stock Change**: After approval or cancellation, push a summary record to the Undo stack.
- **Undo Last Action**: Reverse the most recent inventory change (moves the action to the Redo stack).
- **Redo Last Undone Action**: Re-apply the last undone change.
- **View Stock Change History**: Display the most recent N records from the Undo stack.

4. File Management

- **Import Product Data**: Load product information from products.txt.
- **Import Shipment Data**: Load shipment entries from shipments.txt.
- **Export Operation Logs**: Save all system actions to log_export.txt.
- **View Log File**: Display the contents of log.txt within the GUI.

5. Statistical Dashboard + Reporting

Implement a real-time dashboard and reporting system that includes the following:

- Total Products in System
- Total Canceled Shipments
- Total Incoming Shipments per Product
- Most Recently Added Shipment (within last 30 days)
- Sort by Shipment Volume (total shipment quantity per product)
- Status Summary: number of Active and Inactive products.
- Shipment with Max Quantity: Identify the shipment with the largest quantity

    - e.g., "Laptop" with 230 total incoming units
- Cancel Rate per Category:
    - Electronics: 3 canceled out of 10 → 30%
    - Furniture: 1 canceled out of 5 → 20%

Print Report (all statistics)

Example Report Format:

```
========== WAREHOUSE REPORT ==========

Total Products: 10
Total Incoming Shipments: 45
Total Approved Shipments: 40
Total Canceled Shipments: 5

Shipment with Max Quantity:
 - SHP103 (Laptop) → 100 units


Most Recently Added Shipment:
 - SHP119 (Monitor-Asus) → 2025-04-15


Cancel Rate Per Category:
 - Electronics: 3/10 (30%)
 - Furniture: 1/5 (20%)


Status Summary:
 - Active Products: 8
 - Inactive Products: 2

Inventory Summary:
 - Laptop: 130 units
 - Monitor: 110 units
```

6. JavaFX GUI Requirements

- **TableView** for displaying Products, Shipments, and Inventory.
- **Navigation Buttons**: Next / Previous for record navigation.
- **Dropdown Menus**: Sorting and filtering by status, category, etc.
- **Date Picker**: Select shipment timestamps, etc.
- **TextArea**: For viewing logs and system messages.
- **File Chooser**: Load or export files.
- **Action Buttons**: Approve, Cancel, Undo, Redo, etc.
- **Confirmation messages** for critical actions, such as deletions and updates.
- **Additional Features** as needed (e.g., search bar, quick filters).

File Formats

products.txt

```
ProductID,Name,Category,Status
P001,Laptop,Electronics,Active
P002,Monitor,Electronics,Active
P003,Desk,Furniture,Active
P004,Printer,Office Supplies,Inactive
```

shipments.txt

```
ShipmentID,ProductID,Quantity,Date
SHP001,P001,10,2024-11-01
SHP002,P001,15,2024-11-02
```

log.txt

```
2024-11-01 09:00:00 | Add Shipment | SHP001 | P001 | +10
2024-11-01 10:30:00 | Cancel Shipment | SHP002 | P001 | -15
```

Example: Operation Table for ("Laptop")

Step	Action Taken	Shipment Queue (Front→ Rear)	Inventory List (add Last)	Canceled Shipments (Add Last)	Undo Stack (→ Top)	Redo Stack
1	Initial State	—	—	—	—	—
2	Add SHP001 (+10)	SHP001	—	—	`Add SHP001`	—
3	Add SHP002 (+15)	SHP001 → SHP002	—	—	`Add SHP001`, `Add SHP002`	—
4	Approve SHP001	SHP002	SHP001 (+10)	—	`Add SHP001`, `Add SHP002`, `Approve SHP001`	—
5	Cancel SHP002	—	SHP001 (+10)	SHP002	`Add SHP001`, `Add SHP002`, `Approve SHP001`, `Cancel SHP002`	—
6	Undo Cancel SHP002	SHP002	SHP001 (+10)	—	`Add SHP001`, `Add SHP002`, `Approve SHP001`	`Cancel SHP002`
7	Redo Cancel SHP002	—	SHP001 (+10)	SHP002	`Add SHP001`, `Add SHP002`, `Approve SHP001`, `Cancel SHP002`	—
8	Add SHP003 (+30)	SHP003	SHP001 (+10)	SHP002	`Add SHP001`, `Add SHP002`, `Approve SHP001`, `Cancel SHP002`, `Add SHP003`	—
9	Approve SHP003	—	SHP001, SHP003	SHP002	`Add SHP001`, `Add SHP002`, `Approve SHP001`, `Cancel SHP002`, `Add SHP003`, `Approve SHP003`	—

Submission Instructions

I. Your application should have all functionalities working properly.

II. All the files mentioned in this project **are examples**. You need to generate your own file with at least 30 records.

III. There must be adequate documentation and comments in the code (e.g., functions, loops, etc.).

IV. Your code should follow coding conventions (e.g., spacing, indentation, etc.) and guidelines (**Remember COMP2311**).

V. This is an **individual Project**. Disciplinary action will be taken against those who **cheat**. Additionally, the use of **AI tools** for generating solutions or **copying from websites** is strictly prohibited. Students found in violation of these policies will face severe consequences. It is crucial to ensure that all work submitted is **your own** and adheres to the **guidelines provided for this project**.

VI. During the discussion**, don't say, "I forgot because I worked on the project one or two weeks ago"**. If you do, **you will receive a zero for the project**. A discussion means **you must be ready and prepared beforehand**. You will be asked about all the functionality, in addition to time and possibly space complexities.

VII. Please submit your Java files (java) and corresponding test text files (txt) via the ITC by Thursday, 8/ 5/2025, at 11:00 PM. Late submissions will not be accepted under any circumstances.

All the Best :)